

above, and slightly paler with shining tips beneath, the basal four fifths of the hairs on both upper and lower surfaces are bluish with a greyish tinge. The ears are more thickly clothed with short hairs than usual in specimens of this genus, and the same remark applies to the tail, which is well covered with coarse short hairs, which lengthen and form a short pencil at the extremity, interspersed through basal two thirds are long fine hairs; the feet are well covered with short hairs; the hairs of the tail are dark brown above and slightly paler beneath; on the feet similar to those on the upper surface of the tail.

The skull closely resembles that of *C. fumigata* in size, but differs in the greater elevation of the premaxillary bones (see 'Monograph of the Insectivora,' pt. iii. fasc. 1, pl. xxviii. fig. 9); the teeth differ from those of that species in some peculiarities of form and implantation, better understood by comparing *op. cit.* pl. xxviii. fig. 9, with fig. 8, than from any description; the anterior cusp of the anterior incisor is conspicuously shorter than in *C. fumigata*.

Length (of an adult female specimen preserved in alcohol): head and body 60 millim., tail 48, ear  $7\frac{1}{2}$ , elbow to end of middle digit (without claw)  $18\frac{1}{2}$ , manus 8, pes  $13\frac{1}{2}$ , length of skull between perpendiculars 20, occipital crest to end of premaxilla 17, greatest width of skull 9, length of upper tooth-row 8.

*Hab.* Transvaal. Type no. 6200, preserved in the collection of the Zoological Museum at Berlin.

#### BIBLIOGRAPHICAL NOTICES.

*A Treatise on the Common Sole (Solea vulgaris), considered both as an Organism and as a Commodity.* By J. T. CUNNINGHAM, M.A. &c.

IN requesting and obtaining the liberal aid of Government and public corporations, as well as that of private individuals throughout Britain, the founders of the Biological Laboratory at Plymouth entailed a certain amount of responsibility—more especially with regard to the first-mentioned; and this work is an earnest of that responsibility. The author of the treatise came to his task with experience gained at the Granton Laboratory and the rich grounds in and off the Forth, and this experience crops up here and there in the work, and adds to the interest as well as to the value of the observations. The work consists of a more or less scientific study of the common sole and an account of the present condition of the sole-fishery, together with the possible practical application of the former to the purpose of maintaining or increasing the supply of soles available for the market.

The first six chapters, constituting Part I., require little comment, being a semipopular account of the classification of flat-fishes, the history of the genus *Solea*, and a description of the species with synonymy. It would have been an acquisition to have figured *Solea Greenii*. In Part II. the osseous system and the fibrous and muscular tissues are elaborately described, and a somewhat detailed account given of the oblique museles, their attachments and connexion with the distortion of the eye and orbit. The description of the viscera and vascular system is mainly valuable in connexion with the unravelling of the mystery which has more or less shrouded the males and the male organs. It was the exceeding smallness of the ripe testes that had puzzled the non-scientific observer, and even some who could not be included in this class. The life-like half-figures of the male and female by Miss Willis, together with the descriptions of Mr. Cunningham, will be of much service to future workers. An account of the nervous system, the skin and its parts follows, comparisons of the scales of various species of soles being made by aid of figures. The sense-organs on the under surface of the snout are shown not to differ from those of the dermal tube of the lateral line.

The sixth chapter of Part II. contains the embryology of the sole. When this was written the author had not seen the ovum immediately after its escape from the ovary, but from a postscript on p. 135 he had been more successful this year (1890). Other naturalists, however, had previously seen it at this stage, and agree that it corresponds with the condition of such forms as the cod in regard to the protoplasm. He calls the zona radiata the vitelline membrane, but does not refer to his former view that it is an extra-vitelline product. The particles of oil which form a kind of ring in the sole's egg are occasionally somewhat more distinct than shown by the author, and vary a little in size, as described in a previous publication, viz. from .0015 to .0004 inch. He does not now hold the view that oil-globules occur in the perivitelline space. Moreover he now locates the oil-globules beneath the trunk of the embryo sole. He prefers the term "segmental cavity" to Prof. Ed. E. Prince's less ambiguous term "germinal cavity." The pigment of the larval sole immediately after hatching appears to differ materially in Scotland (*vide* Trans. Roy. Soc. Edinb. vol. xxxv. pl. xvii. fig. 13, Feb. 1890), since it is not truly yellow, but dull stone-grey or dull yellowish white, and this afterwards changes into the ochreous hue so characteristic of the post-larval sole (*vide* 'Report of the Scotch Fishery Board,' July 1889, pl. iii. fig. 9).

The author did not succeed in keeping the larvæ alive more than a few hours until this spring (May 1890), and then only till the yolk "was almost absorbed." Elsewhere experience differs, and the sole has been found to be one of the hardiest larvæ under treatment. He has also overlooked the late larval stage referred to at the end of the previous paragraph: but he has made an interesting addition in securing a young sole  $\frac{3}{4}$  inch long from Mevagissey, showing most of the features of the adult.

He next describes the ova of *Solea variegata*, which measure 1'28 to 1'36 millim. in diameter, and differ from those of the common sole in having oil-globules of considerable size scattered separately over the yolk; but the ova of *Solea lutea*, which are similar though smaller (those measured by Mr. Holt being '78 to '84 millim.), have apparently not been captured near Plymouth, where young specimens are "fairly common."

In Part III. the geographical distribution of the soles and their habits are considered. He speaks of the sole as rarely, if ever, captured by any other instrument than the trawl; but, like the plaice, it can be captured by the hook with suitable bait—some of the finest examples at St. Andrews being procured in this way. His remarks on the food of the sole are interesting and only require the addition that the lobworm is a prominent feature in its dietary.

In Chapter IV. an account of the breeding of the sole is given, and he is probably right that under certain conditions, as in the flounder and plaice, a large part of the ovary ripens its contents simultaneously. The spawning-period is lengthened—those in the south, according to the author, spawning in February, March, and April, while in Scotland the period ranges from May to August. The small size of the testes of the male is remarkable, and the statement quoted from Nordman that a species of sole adhered during copulation is noteworthy. With the exception of the experiments in the spring of 1890, as stated in the postscript, the hatching of the soles at Plymouth was difficult.

The author is of opinion that soles spawned in March have completed their metamorphosis by the middle of May, when they are  $\frac{1}{2}$  to  $\frac{9}{16}$  inch long, and that on May 31st they are  $\frac{3}{4}$  inch, and that in one year they grow about 5 inches in length. Those  $6\frac{3}{4}$  to  $9\frac{3}{4}$  inches are just over two years. He thinks that soles 14 inches long are four years old, and those 20 inches long about six years. His diagnosis in regard to the first year is, however, uncertain.

Part IV. is devoted to what is called Economical subjects, and in this part considerable condensation might have been effected. In artificial fertilization the author crushed the testes, as indeed is the common plan with the gurnard and others at St. Andrews, and which Dr. Wilson found equally satisfactory in the mussel. An ingenious apparatus, slightly differing from Captain Chester's, of the United-States Fish Commission, is figured and explained by the author. Experience elsewhere shows that success can be obtained with open vessels, and the more simple such apparatus is the better. He is of opinion that a railway journey jolts and mechanically injures the pelagic eggs; but this may be exceptional, since in 1884, and often since, ova fertilized far out at sea have afterwards been safely sent by railway from distant places, such as Aberdeen or Macduff, to St. Andrews.

The author thinks that the sole-fishery is declining, and some pungent remarks are made in regard to fishery statistics which were only lately put on a proper footing—thanks to the late Lord Dalhousie's Commission. He rightly suggests the desirability of fertil-

izing the ova of ripe forms captured in the trawl, and returning them to the sea, an idea which originated with the Americans in regard to the cod. Little training would really be necessary for this, since the skippers of trawling-vessels and not a few line-fishermen in Scotland readily and successfully carry out artificial fertilization.

The plates attached to the work are eighteen in number, and of these twelve are coloured. Certainly no expense has been spared in regard to the first nine—the work of an accomplished artist, Miss Willis. A smaller number of coloured figures of the common sole perhaps might have sufficed. In the structural figures great care has been exercised by the author, though the effect after lithographing is sometimes a little harsh, *e. g.* in plates x. and xii. Some of the figures in the last three plates (done in Jena) are very neat, though there are a few small structural omissions, such as the absence of the hypural and epural elements in the transparent tails of the young flounders in pl. xvii. fig. 5 and pl. xviii. fig. 1.

In the preparation of this treatise the author has had to consult popular favour and at the same time promote the advancement of science. On the whole he has accomplished his task with much perseverance and ability; and though there are omissions of moment and a tendency to take somewhat limited views of various questions, still the work is creditable and noteworthy both in regard to the fisheries and zoology.

W. C. M.

*A Zoological Pocket-Book, or Synopsis of Animal Classification.* By Dr. EMIL SELENKA and J. R. AINSWORTH DAVIS. Charles Griffin & Co.: London, 1890.

THIS is a translation by Mr. Ainsworth Davis of the third edition of Dr. Selenka's 'Zoological Pocket-Book.' It consists of a series of classificatory schedules, comprising definitions of the phyla, classes, and orders of the animal kingdom, together with explanatory remarks and tables. At the end of the book Mr. Davis has added some useful "Notes on Distribution," and also a table showing the "Geological Range of the chief Animal Groups." The book is interleaved with blank paper for the reception of brief synopses of "voluminous lecture-notes, or, in some cases, definitions of families and smaller subdivisions." The size of the book (small octavo) renders it an extremely handy little volume, and different-sized type is usefully employed in order to emphasize the various classificatory divisions. The book is, of course, intended for students, but its value will largely depend upon the way in which it is used. Thus, for a "short-course" man, struggling with the anatomy of his half-dozen types, schedules such as these would scarcely be necessary, and, if used, would probably be productive of much confusion. The more advanced student, on the other hand, who has received a good general grounding in zoology, will be certain to find this little book of much assistance in preparing for examination. In the face of